The case of Honda: A dialectical yet coherent firm

W. David Holford and Mehran Ebrahimi

Abstract—This conceptual paper proposes that Honda’s innovative prowess of producing both radical and disruptive innovations within their aerospace and automotive/pick-up truck development activities can be traced back to its organizational culture of continually embracing opposites or contradiction across dialectical synthesis. It is this synthesis of various ‘contradictions’ or viewpoints that gives the firm and its resulting disruptive innovations the simultaneous characteristic of continuity and novelty. Such a pattern was discerned across second hand data related to the development of the HondaJet and Ridgeline; and appears to confirm both Nonaka and Toyama’s thesis of the dialectical firm, as well as Christensen’s thesis of the feasibility of producing distinctive innovations at relatively low costs. Key organizational enablers towards attaining such an organizational reality requires management focus on nurturing mutual trust, care, empathy, redundancy of information and requisite variety.

Index Terms—Dialectical synthesis, disruptive innovation, contradiction, knowledge dyads.

I. INTRODUCTION

Historically, the Honda Motor Co. has been somewhat of an enigma to various researchers in management – many contradictory positions seemed apparently justified when looking at various aspects in isolation. Its pursuit of R&D activities appears to pose the same paradox. It is well known that Honda takes a long term view to R&D, and its resultant products are recognized as being of excellent quality. And yet paradoxically, Honda also has the habit of developing successful products that are not only new to its historical business markets, but offer significant differentiating product attributes. For example, Honda’s first experience and resounding success in the North American motorcycle market in the 1970’s is described by Christensen [3] as an example of having developed a disruptive technology across its 50 cc motorbike; while Honda’s 1st pick-up truck (the Ridgeline) unveiled in 2005, won the NAIAS North American Truck of the Year Award in early 2006 along with numerous positive comments related to its innovative design, and better than expected sales. And with its recent announcements to enter the microjet market across the commercialization of its HondaJet aircraft, history has shown that Honda does not enter such new adventures with a “me-too” approach.

In examining key aerospace and automotive/pick-up truck R&D initiatives Honda pursued in recent years, we propose that its R&D ‘strategy’ and activities are indeed coherent, but within a dialectical movement. This paper first examines the evolution of the technical aspects and technologies that led to the differentiating attributes of the HondaJet and the Honda Ridgeline pick-up truck by conducting a critical hermeneutic analysis of publicly available documents related to Honda’s aerospace and automotive/pick-up truck R&D. We then attempt to identify the key factors within Honda’s organizational environment that allowed its employees to generate such technologies and differentiating product attributes. We will show that Honda is a dialectical firm within a coherent continuity; and in turn, that its organizational approach has a natural affinity and predisposition towards generating disruptive innovations as defined by Christensen [3].

II. ‘METHODOLOGY’

The methodology pursued in this proposed conceptual paper, in many ways resembles nothing more than a sophisticated literature survey. No firsthand empirical data was collected on the part of the authors. It is simply through a critical hermeneutical analysis of key R&D reports and interviews related to two key product development initiatives (HondaJet and Ridgeline) that key (albeit second-hand) technical data and verbatim were first manually analyzed. This was coupled with a detailed review of past organizational research conducted on Honda as well as certain academic texts addressing the topic of innovation. Key linkages between certain concepts and the original technical and verbal information associated to the development of the HondaJet and Ridgeline allowed us to first confirm one major organizational proposition (i.e. the dialectical firm), as well as to highlight its outcome and predisposition with the notion of disruptive innovations. No statistical analysis related to frequency counts or weighting was conducted. The proposed associations and ideas presented in this paper were primarily based on the quality of matching of linguistic terms in the technical and verbal data with that found in the literature on innovation and organizational theory.
III. THE HONDAJET

The HondaJet can seat up to 6 people with a maximum speed of 420 knots and a service ceiling of 41,000 ft. The aircraft is fitted with a state-of-the-art glass cockpit, integrated avionics system, an autopilot function, and anti-icing equipment. The engines are “optimally positioned on the upper surface of the main wing in a unique configuration that reduces drag at high speeds and increases cruising efficiency. This eliminates the need for structural engine mounts in the fuselage, creating 30% more cabin space than in conventional aircraft” [2]. The main wing, which features aluminum skin panels formed from single sheets of aluminum, provide a smoother than conventional surface. This, combined with Honda’s proprietary low-drag laminar flow wing section (SMH-1), work together to significantly improve aerodynamic performance. Additional drag reducing technologies include the fuselage nose section designed to generate laminar flow to reduce drag on the fuselage. The fuselage is a compact and lightweight co-cured carbon composite and honeycomb sandwich structure which allows Honda to gain more interior space. Honda claims that these features, along with its “fuel efficient HF118 turbofan engine”, allows the aircraft to achieve fuel efficiency that is over 40% higher than conventional aircraft. In this regard, the HondaJet, with its radical improvement in existing performance attributes of cabin space and fuel efficiency, would appear at first glance to constitute a radical (as opposed to a disruptive) innovation in the spirit of Christensen’s [3] definition. Table I tabulates technologies contributing towards superior fuel efficiency and cabin space.

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<tr>
<th>30% more cabin space</th>
<th>40% more fuel efficiency</th>
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<td>Over-the-wing engine mounts</td>
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<td>Co-cured composite fuselage</td>
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<td>Honda SMH-1 natural laminar flow</td>
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<td>Main wing: skin panels made from</td>
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<td>Laminar flow nose section</td>
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<td>HF118 turbofan engines</td>
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The evolution of these specific technologies can in certain ways be traced back over three sequential aircraft research programs over the past 20 years. In 1986, a joint research agreement was first initiated by the Mississippi State University (MSU) and Honda R&D [8] involving a Beech A-36 aircraft modified step-by-step to replace major structural elements with a composite structure. This was followed in 1989, with the MH-02 joint research aircraft project between MSU and Honda R&D, culminating in a prototype 6-passenger jet airplane in 1992 [8], [10]. It was described as being “the first all-composite small business jet, using lightweight carbon fiber reinforced epoxy resins in all the structural elements ranging from main and tail wing cross beams and ribs, to fuselage frame and other outer panels” [10].

As for the HondaJet itself, the exact date in which development first began could not be established with exactitude. In July 2003, Fujino [14] reported that by locating the over-the-wing engine-mount and nacelles at optimum positions, “this configuration reduces drag at high speeds and maximizes the cabin volume”. The fuselage is described as a graphite composite structure using a honeycomb sandwich construction in both the cockpit and tail section to maintain the compound curves required for laminar flow, and an integrally stiffened panel structure in the constant cross-section portion of the cabin to maximize cabin volume. Honda was counting heavily on the benefits of natural laminar flow to achieve the targeted efficiencies [15]. Its HF118 turbofan engines were also to play a role in this regard, and are described as having “the first ultra-compact Full Authority Digital Electronic (FADEC) system for this class of engine”, based on electronic control technology originally developed for automotive applications [1]. Unconfirmed reports back in 2004 had the engine as much as 10% more efficient than comparable engines [18].

Coherency Between the Development Programs:

A certain coherency and continuity between the three aircraft development programs was discerned in terms of technology and design themes.

From a technology aspect, the converted Beech A-36 research program involved the learning and gaining of experience of composite material design, fabrication and testing [8, 9]. Composite materials were subsequently carried forward into both the MH-02 and HondaJet programs [8], [11], [14], [15]. In addition, above-wing engine mounts were first seen on the MH-02 and then carried onto the HondaJet. Technology leveraging from Honda’s automotive expertise was discerned in at least two development programs: Honda’s experience in resin mould fabrication for automobile modeling helped the MH-02 aircraft program team produce master moulds required for composite material fabrication [8], [11]; and the HondaJet H118 turbofan engines’ FADEC systems based on electronic control technology originally developed for automotive applications [1].

From the design aspect, the Beech A-36 program had a ‘Safety First’ design philosophy and high emphasis on quality control of the composite fabrication processes [8], [9]. ‘Safety First’ and high emphasis on ‘total quality control’ was also evident in the MH-02 program [8], [11]. The automobile design theme was seen in both the MH-02 and the HondaJet: Fujino describes how one of the design requirements of the MH-02 was that the crew and passengers could easily get on or off the aircraft without any steps, “just like an automobile” [12], and the chief test pilot had described that “the crew seating is very low to the ground and provides a ‘sports car’ view and feel” [13]; while Honda Motor president Fukui had referred to the HondaJet as “We have created a business jet with high performance, high fuel efficiency, low emissions and a spacious cabin. Sounds like a Honda, right?” [38]. The sub-theme of more cabin space was seen in both the MH-02 and the HondaJet: one of the reasons for the forward sweep
wing design on the MH-02 was to gain more cabin space [8], [11]; while for the HondaJet significant cabin space was achieved via over-wing engine mounts and the composite material fuselage [14], [15]. In this sense, the way in which radical improvements in existing product attributes were achieved (e.g. extra cabin space coupled with the glass cockpit and higher fuel efficiency) produced the new product attribute (relative to the competition) of a car-like feel to the aircraft. In this sense the HondaJet can be viewed as being both a radical and a disruptive innovation in the spirit of Christensen’s [3] definition.

Despite limited literature, we also discerned a coherency between Honda’s three turbofan development activities (the HFX-01 and HFX20 leading up to the HF118), whereby all had a common objective of trying to attain superior fuel efficiency (SFC) [1], [6], [17], [20].

IV. HONDA RIDGELINE

Between its first launch in 2005 and having won the NAIAS 2006 North American Truck of the Year Award early in the new year (collecting 296 out of a possible 490 votes), Honda’s first pick-up truck was described by numerous automotive reviews as a vehicle that “doesn’t look or act like any other pickup truck we’ve ever driven. It has a family storage solution in its bed that no other pickup truck can match”…“The Ridgeline is one of the nicest midsize trucks we’ve driven in terms of comfort and ease of use”…“The Ridgeline sets a new paradigm in terms of body structure for a pick-up”… “The light truck segment has been one to present more of the same year after year. Honda steps up and redefines the genre with what has to be the most innovative vehicle in a long time” [21]-[24].

Highlights of the new Ridgeline pick-up includes: 1) an innovative new integrated cab and bed unibody construction, resulting in a body-chassis structure that has 20 times the torsional stiffness and two-and-a-half times the bending stiffness of a competitive body-on-frame truck; 2) the first four-wheel, fully independent suspension system to deliver a superior car-like ride and handling, while maintaining the conventional strength of a truck; 3) the industry’s first In-Bed Trunk, featuring 8.5 cubic feet of secure, lockable and waterproof storage space, made possible via the elimination of the full rear-axle; and 4) a “Dual Action” tailgate, hinged at the bottom and side for both drop-down and swing-out operations, thus giving easier access to the trunk [25].

The overall differentiating attributes of the Ridgeline can be summarized as a mid-size pick-up truck offering superior cabin and rear-bed space with a loading capacity matching large-sized pick-ups; coupled with car-like comfort and handling [21]-[25]. Furthermore, Honda’s incorporation of new car-like performance attributes (comfort, handling and cabin space) to existing conventional pick-up truck attributes of strength, etc., allows us to once again consider the Ridgeline as a disruptive innovation as defined by Christensen [3].

A. Signs of Coherent Continuity

A core team of 37 engineers, led by project engineer Gary Flint, did the engineering design work on the truck in a little over four years. The total development time was five years. During this period at least two separate prototypes were built prior to attaining the final design product. One particularly telling, yet paradoxical comment, comes from Lindsay Brooke, a senior analyst at CSM Worldwide at Farmington Hills, Mich. inn stating that “For decades, they've [Honda] mastered the art of developing new vehicles without creating all-new ones, using many carryover parts and common assembly processes” [24]. Brooke’s comments carry a certain degree of validity when considering that the starting point of many of the Ridgeline’s innovative features began with the Honda Pilot (SUV). In this respect we see a coherent continuity with Honda’s past experience. But although the Ridgeline’s integrated body-on-frame chassis construction stems from the Honda Pilot SUV, the structure has been significantly changed, with 93 percent being unique to the new truck. The Pilot's five-speed automatic has been extensively reengineered for pickup duty, helping to give the Ridgeline a 5000-pound towing capacity. The front-strut, rear-multilink suspension design is also carried over from the Pilot, but it, too, has been strengthened to handle additional loads [22], [26]. But we will see further on in section 5 that there are essentially three sources of ideas flowing into the Ridgeline: past and existing in-house experience, existing ideas external to the firm, and “new” ideas which are either bona-fide new ideas or are inspired from past technologies or applications from other remotely related industries or markets.

Other apparent “streams” of continuity can be seen to overlap with other R&D divisions within the Honda Motor Co., including Honda’s aviation development activities with respect to a safety-first design philosophy (in actual fact, the Ridgeline did not borrow this philosophy from Honda’s aviation R&D arm, but rather is a corporate wide vision and value that can be readily seen when visiting their corporate web site). Other specific similarities with the HondaJet design themes can be seen across the Ridgeline’s development team’s quest for superior cabin and rear bed space, as well as the handling and comfort of a car (remember the “Honda civic of the sky?”).

V. THE HONDA MOTOR COMPANY

Most researchers would agree with Cooper [19], that Honda is an “industry innovator”. Yet many of these same researchers have used Honda to support their respective theses as to why this is so. Mair [33] critically analyzed much of this previous literature and argued that Honda had been cited to illustrate “apparently contradictory positions on a series of conceptual dichotomies, namely analytical planning versus learning, market positioning versus resource-based and…core competencies versus core capabilities”. He explained that Honda’s management thinking is based on the reconciliation of conceptual dichotomies which in turn produced Honda’s dichotomy-reconciling strategic capability, as well as being a “specific route to innovation”. This argument is consistent
with Pascale’s [34] earlier description of Honda’s management as being able to use paradox and contradiction as an explicit management tool. Nonaka et al [35]-[37] goes further by providing an explicit explanation as to how contradiction within an organization is embraced and harnessed in a dialectical fashion (often citing Honda as an example) leading to the generation of a continuous process of knowledge creation, innovation and overall business strategy.

A. Honda as a Dialectical Firm

According to [35] and [37], all knowledge is viewed from a certain angle and within specific conditions, and is a perspective within Honda that involves dialectical thought. This method of thought, involves a starting point of knowledge or thesis, whereby one then looks for its contradiction or antithesis. This stage may also be inadequate, and therefore a following stage is pursued whereby the previous thesis and anti-thesis are reconciled through a synthesis. Eventually, this synthesis over time will turn out to be one sided in some respect, and therefore serves as the thesis for a new dialectical movement. Hence, contradictions are synthesized through “dynamic interactions among individuals, the organization, and the environment. Knowledge is created in the spiral that goes through seemingly antithetical concepts such as order and chaos, micro and macro, part and whole, mind and body, tacit and explicit, self and other, deduction and induction, and creativity and efficiency” [36: p.2]. The following are examples of how Honda uses this approach in embracing or synthesizing opposites.

1) A knowledge vision which synthesizes Honda’s absolute and relative value systems:

The knowledge vision provides an important criterion for judging the value of knowledge perceived or created, and fosters a context of organizational commitment towards creating and circulating knowledge across the organization [37]. Honda has been illustrated as an example of having a knowledge vision synthesizing both the absolute and relative value systems of the firm [35]. On the one hand, it emphasizes a vision which is not affected by outside conditions so as to ensure that it can achieve consistency and uniqueness in its knowledge creating activities. On the other hand, as Nonaka states, “a firm cannot ignore the environment with which it interacts. A firm needs to adjust its operations according to the changes in the environment including competitors, etc….” If we listen to the words of Honda president Fukui, we discern a knowledge vision which synthesizes these two aspects: “Mobility is a basic desire, right and joy for all people. Honda continues to pursue mobility from all dimensions. Mobility in the third dimension – the sky – was a dream we have had since shortly after our company was founded. The words of our founder, ‘Do not imitate others’ are burned in the minds of everyone at Honda. We have no interest in following.” [38]. All knowledge generated by Honda will on the one hand be judged against the absolute criteria of mobility and uniqueness. On the other hand it will also be judged against the relative value of pursuing ‘the third dimension – the sky’.

The HondaJet as an aircraft with 30% more cabin space and 40% higher fuel efficiency than conventional aircraft clearly meets these criteria.

2) Synthesis of bottom-up and top-down management:

Honda has been illustrated as an example of using a ‘middle-up-down’ management approach synthesizing both the bottom-up and top-down methods, by placing the middle manager in the center of knowledge creation, whereby he is positioned at the intersection of vertical and horizontal flows of information within the company, and is often the leader of a team or task force [39: p.129]. “Middle managers try to solve the contradiction between what top management hopes to create and what actually exists in the real world” – in other words, top management creates a vision, while middle management, along with the employees, develops more concrete concepts that front-line employees can understand and implement. During the concept creation of the Honda City car back in the late 1970’s, top management wanted to create “something different from the existing concept” and launched the project with the slogan “Let’s Gamble”. Middle-management with the front-line workers developed the more concrete concepts of “automobile evolution”, “man-maximum, machine minimum” and “Tall Boy” (for tall interior space) which front-line employees could more easily implement.

3) Synthesis of realistic and idealistic principles:

According to [35], Honda use “two contradicting principles” in daily practice. One is the emphasis on the importance of reality or ‘go to the actual place, know the actual situation, be realistic’. For example, Gary Flint, in the development of the Ridgeline, refers to the Japanese term sangen-shugi, which means “go to the spot”, which he used towards conducting his own market research on customer wants and needs (which was conducted over and above the traditional listening to customer focus groups). The other principle is emphasis on the importance of the ideal by respecting ‘sound theory’. In this regard, the Ridgeline development team used the theory behind unibody construction to gain additional resistance to bending and twisting. The philosophy of realistic and idealistic principles is clearly seen across Richard Truett’s [24] explanation that “Honda engineers can't just show their bosses diagrams and drawings. They have to design parts that solve problems”.

Reference [35] also explain that Honda typically synthesized these two principles (practice and theory) across three levels of questions. One level will look at specifications such as ‘what is the aircraft cabin space?’ etc. A higher level will look at conceptual and design issues such as ‘what is the design of the aircraft cabin?’. The highest level will look at basic essential questions, such as ‘what is this aircraft for?’. When a problem cannot be solved, Honda engineers go up a level in terms of questioning: so if cabin space cannot be agreed upon, they go back up to ‘what is the design of the cabin?’.
4) Synthesis of consensus and open debate: Reference [40] explains that a “characteristic of Japanese teams is the concept of consensus.” This observation is in line with [41] who sees the concept of consensus as a key characteristic of the Japanese “model”. But Kiernan [42] points out that in Honda the constant questioning of ideas, decisions and management is encouraged, even demanded of each employee. Kiernan adds, “Design and development teams are deliberately staffed with engineers from peripheral disciplines who are unfamiliar with the core technology under development. This is to ensure that problems will be approached from different and innovative perspectives, and that conventional wisdom will be challenged and tested.” He refers to Richard Pascale who termed this the art of ‘constructive contention’. Along these lines, Pascale [34], [43] refers to Waigaya, a contention management protocol where people listen to one another, and can disagree without being disagreeable. This requires management being skilful at facilitating these sessions “so as to surface thoughts and feelings present and move toward constructive action”. Waigaya is essentially a synthesis of open debate and consensus/respect. We see waigaya as being an important factor in generating the various concepts within the MH-02 experimental aircraft (use of lightweight carbon composites in all structural elements, forward swept wing and over-the-wing engine mounts) and HondaJet projects (SHM-1 laminar flow wing section, composite fuselage, laminar flow nose design, etc.). We can also discern the synthesis of open debate and consensus within the Ridgeline project development team across Gary Flint’s Ridgeline development team who, like all development teams at Honda, “debate, discuss, examine and analyze the engineering and marketing data and from that, they implement a comprehensive product plan. Then they set to work. Once a decision is made, that’s it - unless, of course, a team member comes up with new and compelling data. Then the action plan can be revisited” [44].

5) Synthesis of different ideas: past vs present, internal vs external, existing vs new, etc.: Reference [36] explains that idea creation can be achieved across the synthesis or integration of opposing aspects through a dynamic process of dialogue and practice. This is precisely what is seen across the team dynamics throughout the development of the Ridgeline pick-up truck, and can also be deduced across some of the R&D documents describing Honda’s aviation development activities. The opposing aspects of interest in this case consist of different ideas being examined, discussed and debated, prior to consensus. For example, some of these ideas can be categorized as existing ‘in-house’ vs existing ‘external’ ideas, across the Ridgeline team’s examination of ‘forgotten’ knowledge as a source of additional ideas. For example, the MH-02/HondaJet teams use of above wing engine mounts was inspired from decades-old technology found on such planes as the Fokker VFW-614. But this technology, originally chosen for increasing cabin space, could not be used without synthesizing it to new ideas, since in its original form presented poor drag characteristics. Eventually, via optimal engine nacelle and pylon positioning and design, what was originally a disadvantage eventually became a strong point, whereby drag characteristics were found to be superior to conventional under-the-wing designs [12], [14]. In a similar way, the Ridgeline team tapped into old ‘station-wagon’ technology for the “Dual Action” tailgate. But its original configuration, presented significant load strength disadvantages. “That’s why we spent a lot of time on the tailgate,” says Flint who refers to it as ‘an engineering marvel’. “The tailgate is so strong, I can back two trucks up to each other and I can park another Ridgeway on top of them” [45].

6) Synthesis of competition and cooperation: Honda’s HF118 turbofan engine is aimed at the small-business jet market, which include both owner and potential ‘air taxi’ operations [46]. But Honda will face other competitors in the HF118’s thrust range such as Williams’ FJ44 and FJ33, and Pratt and Whitney’s new PW600 series engines [7]. On the other hand, Honda’s alliance with GE is expected to “shave-off the two years it can take to get a new engine certified” (USA Today, Feb. 16, 2004), whereby Honda will be able to draw upon GE’s innovative design and materials technology, as well as sales and support [46], (Oakland Press, Oct. 14, 2004). This was already seen across Dubois’ [5] report in 2006 on how the cooperative design and testing efforts had already resulted in a further improvement of 5% in specific fuel consumption and 15% in weight reduction, due in part to: 1) Honda’s enhancement to its state-of-the-art high pressure compressor (HPC) towards increased airflow and improved efficiency; 2) improvements in the high-pressure turbine (HPT) via the use of GE’s advanced single-crystal material; and 3) the use of wide-chord fan blade technology deriving from the GE 90 engine. In this regard, the HF118 engine represents a synthesis of competition and co-operation.

7) Synthesis of global and local: Honda’s president Fukui references the “Made by Global Honda” strategy, whereby in conjunction with increased regional autonomy, it focuses on improving efficiency and strengthening the automobile model line-up of each region [47]. Similarly, Honda’s web page on Worldwide Automobile
Production and Logistics states: “Blending international experience with technological expertise to adapt to local and regional circumstances, Honda achieves consistently high quality worldwide”, while Honda’s webpage related to R&D and Overseas Development says: “Our experience teaches us that global business begins with active participation at the local level...Honda R&D develops technologies and products that reflect the needs of people in individual regions, yet bound together by common values...”. All of these words remind us of Gidden’s [48] explanation of the process of globalization within modern society which involves the dialectical process between distant and local happenings or events, whereby relations become “stretched” across a worldwide network. He explains that one aspect of this dialectical nature is the “push and pull” between tendencies towards centralization and de-centralization (or regionalisation). In examining Honda’s aircraft development activities over the past 19 years, we discerned a similar type of dialectical relation. A local or de-centralized dimension was seen via the R&D conducted by both the Mississippi State University for the converted Beech A-36 and MIH-02 programs, and the Honda R&D Americas facility in Greensboro, North Carolina for the HondaJet program [49]. Conversely, a centralized aspect throughout all three aircraft development programs was seen via strong linkages to a centralized home base represented by the Wako Research Center, Wako, Saitama, Japan.

B. Honda as an Example of the SECI Approach to Knowledge Creation

The synthesizing of opposites within Honda is conducted through the SECI (socialization, externalization, combination, internalization) approach to knowledge creation [39]. Honda’s ‘brainstorming camps’, tama dashi kai, are an example of socialization (conversion of tacit to tacit knowledge) – consisting of informal meetings for detailed discussions to solve difficult problems in development projects, often at a resort inn, while drinking sake: “Such a camp is not only a forum for creative dialogue but also a medium for sharing experience and enhancing mutual trust among participants” [39: p.63]. These meetings are open to any employees interested in the development project underway, whereby criticism is accompanied with constructive suggestions.

Externalization (conversion of tacit to explicit knowledge) is typically seen in the process of concept creation and is triggered by dialogue, collective reflection, as well as debate/consensus (as discussed in section V. B), whereby the use of a metaphor or analogy can be highly effective in fostering direct commitment to the creative process. During Honda’s development of the Honda Civic, the project team used the metaphor ‘Automobile Evolution’ [39: p.64]. They viewed the automobile as an organism, and asked themselves “What will the automobile eventually evolve into?” Further dialogue and reflection eventually led to the “concept of a tall and short car – ‘Tall Boy’ – emerging through analogy between the concept of ‘man-maximum, machine-minimum’ and an image of a sphere that contains the maximum volume within the minimum area of surface...”. In the case of the HondaJet, the design concept chosen is clearly illustrated by Honda president Fukui’s words and analogy of “Honda wants to build a Honda Civic of the sky” and “We have created a business jet with high performance, high fuel efficiency, low emissions and a spacious cabin. Sounds like a Honda, right?”.

Reference [39: p.69-70] also cites Honda as an example for internalization or learning (conversion of explicit to tacit knowledge). He explains that experiences gained through socialization, externalization and combination are internalized into individuals’ tacit knowledge bases, whereby in this case “all the members of the Honda City project team, for example, internalized their experiences of the late 1970’s and are now making use of that know-how and leading R&D projects in the company.” In the case of the HondaJet, we can deduce that the fruit of its technical achievements are in many ways related to the internalization or learning of knowledge achieved in both the converted Beech A-36 and MIH-02 6-passenger jet aircraft development programs (composite material know-how, over-the-wing engine mount configuration, various methods to increase cabin space, the automobile design theme, etc.).

VI. A Predisposition Towards Creating Disruptive Innovations

We already saw across Honda’s synthesis of ‘contradictions’, that a large number of possible dyadic pairs may exist depending on the context at hand (e.g. tacit vs explicit knowledge, external vs internal knowledge, the theory vs practice, cooperation vs competition, etc.). Furthermore, each series of differing viewpoints offers a multitude of dyadic arrangements of concepts to be synthesized across dialectical interactions and sense-making between individuals or groups of individuals and organizations via dialogue and practice. Hence, complementary oppositions or contradictions are not entraped in an “either/or” dichotomy, and thereby avoids being limited to only one half of the dynamics within the vast spectrum of dyadic ‘pairs’. This also rejoins Karl Weick’s [27] argument for what he calls mindfulness in managing the unexpected, whereby divergent perspectives provide a broader set of assumptions and sensitivity to a greater variety of inputs. This in turn can lead to a richer synthesis of more complex knowledge in the face of ever-increasing complex environments.

It can also be argued that dialectical synthesis also has natural affinities towards achieving disruptive innovations as defined by Christensen [3]. Although we are somewhat loath towards choosing one particular category of dyadic synthesis over another with respect to which has the most propensity for producing disruptive innovations (in that firstly, we view the dialectical approach of Honda as being a systemic approach throughout the organization involving a variety of ontological and epistemological levels; and secondly, as soon as one chooses or focuses on one component of a system over another, the overall system as we know it ceases to exist), if one simply focuses on the visible product innovation aspect, we could (albeit simplistically) say that the past vs present/old
Disruptive innovation involve products that offer new product attributes as compared to existing products (as opposed to radical innovation which involve products with radical improvements in existing product performance attributes; or sustaining innovation which involves a more moderate improvement in these same existing product performance attributes). For example back in the late 80’s, the supplanting of 3.5 inch memory hard disk storage in the computer industry (1989) by 2.5 inch drives occurred because the latter were able to offer what the market needed with respect to storage capacity, while offering the added performance attributes of being more compact, lighter, rugged and requiring less power consumption. Paradoxically, the development of the 2.5 inch disk drive was also technologically straightforward in that it involved “off-the-shelf” components put together in a product architecture that was simpler than the prior approach [3]. An example that illustrates sustaining innovation in comparison to disruptive innovation involves the development of warfare strategies leading up to the Second World War. The French invested heavily in new technology to build the state-of-the-art fortifications in the Maginot Line as a barrier to invasion. Germany, however, took “off the shelf” technologies (aircraft, armor and radio) and developed new ways to exploit them (motorized infantry and decentralized command and control). In this way, what became known as “Blitzkrieg” became a disruptive innovation. German forces didn’t directly assault the Maginot Line. They instead relied on mobility and air power to bypass it and strike at the heart of the country. The French, unprepared to defend against fast-moving aggressors, surrendered six weeks after the invasion started. The Maginot Line, from an innovation point of view, performed as designed and represented a “sustained” improvement over World War I trench-warfare philosophy. The Germans never penetrated it. They simply went around it. Thus, disruptive innovations typically does not need to involve the development of new and costly technologies. In fact, it often involves existing knowledge (in this case, off-the-shelf knowledge and technologies) being synthesized with new knowledge (e.g. new architectures, assemblies or interfaces) and/or internal knowledge being synthesized with external knowledge. The same can be said for the Honda Ridgeline and the HondaJet, which represented existing knowledge (which in itself involved the synthesis of internal and external knowledge) synthesized with new knowledge (e.g. new ways of putting this existing knowledge together, new unibody construction, optimization of engine position and nacelles, etc.); hence resulting in a pick-up truck or aircraft that has all the existing (albeit in many ways improved) performance attributes of conventional products combined with the added performance attribute of car-like handling, space and comfort (refer back to Section V-A-5 for more detailed description of the synthesis of the knowledge dyads in question).

The dialectical synthesis approach allows for partial ruptures with past and existing knowledge, while also allowing for building upon this same existing knowledge. It therefore comes as no surprise when Lindsay Brooke, a senior analyst at CSM Worldwide at Farmington Hills, Mich. stated that “For decades, they've [Honda] mastered the art of developing new vehicles without creating all-new ones, using many carryover parts and common assembly processes” [24]. Brooke’s comments are certainly valid when considering that the starting point of many of the Ridgeline’s innovative features began with the Honda Pilot (SUV). In this respect we see a coherent continuity with Honda’s past experience. But although the Ridgeline’s integrated body-on-frame chassis construction stems from the Honda Pilot SUV, the structure had been significantly changed, with 93 percent being unique to the new truck. The Pilot's five-speed automatic had also been extensively reengineered for pickup duty, helping to give the Ridgeline a 5000-pound towing capacity. The front-strut, rear-multilink suspension design was also carried over from the Pilot, but it, too, was strengthened to handle additional loads [22], [26].

Consistent with Christensen’s thesis that disruptive innovation need not be costly relative to radical or sustaining innovation, the Ridgeline’s project team leader Gary Flint, who worked for 15 years at GM and helped engineer the Chevrolet S10 pick-up prior to joining Honda 12 years ago, explained that “The project's total cost came in well under $250 million...Compared to General Motors, (the Ridgeline's cost) is peanuts,” [24]. This is because one doesn’t need to start from scratch to generate a disruptive innovation; but only needs to superimpose a new or external concept design onto existing knowledge or platforms. Although we could not obtain direct product development cost comparisons between the Ridgeline and its competitors for 2005 (which is the year the Ridgeline was unveiled), generic 2002 data showed GM to be spending over $400 million per product development project [28]. Yet, GM designs were at that time viewed as being relatively dull and “stodgy” [28].

A. Dynamic dialectical synthesis vs deductive “flip-flop”

A more recent article in 2004 suggested that both Ford and GM were finally starting to make inroads on reducing development costs after having “diligently studied how Japanese engineer more cars for less money, using a similar set of chassis and frame parts to create a common vehicle architecture” [29]. Yet for the past two years or three years, while certain analyst have been clamoring for evermore cost reductions, others seem to have increased their focus on the innovation side of the equation: for example, GM is seen as lacking “product appeal” due to “short term thinking”; that “rotten cars, not high costs, are driving GM to ruin”; or that both GM and Ford are perceived as needing “hit cars” to “refresh their product lineup” [30], [31], [51]. In contrast, numerous reports refer to Honda’s Civic re-designed Si, Coupe, Hybrid and sedan versions for its success [32], [52]. In fact, the re-designed Honda Civic had won Motor Trend’s
2006 Car of the Year Award on all four counts. At first glance, approaches between GM and Honda appear similar in that both started with existing platforms, knowledge and routines. Yet once again, Honda embraces and synthesizes both elements of the dyad: that is, the existing with the new, whereby Honda engineers having started with existing ‘routines’ or knowledge, ended up with a markedly different looking vehicle. Furthermore, the hybrid version brought in the added “green” aspect thus transforming it into a disruptive innovation. So while GM had focused on standardization to achieve cost reductions, whereby large proportions of routines were more or less frozen across several models, Honda pursued what Nonaka and Toyama [35] refer to as “creative routines”. In this latter approach, standardization is viewed as a synthesis of standardization and continuous improvement/creative change in a dynamic and perpetual manner, as opposed to the inertia-setting routines found within firms described by Nelson and Winter [53] or Teece et al [54].

In looking at product development times, Honda does not seem to stand out particularly well. For example, the Ridgeline took close to five years to develop and commercialize [45]. This is not particularly impressive compared to what was up until a couple of years ago the industry standard of 4 years [55]. Furthermore, companies such as GM and DaimlerChrysler have been aiming towards significantly cutting that cycle time by 50% or more via internet based technologies such as ERP (Enterprise Resource Planning) and EDI (Electronic Data Interchange) [55], as well as with supercomputing for both early and late stage design [57]. While the merits of such techniques and approaches cannot be disputed in regards to the time and cost savings opportunities it offers, cycle time reduction alone does not ensure competitive advantage and distinctive innovation [58]. Weick [27], [59], [60] reminds us that knowledge creation 1st starts across individual sense-making. For sense-making to lead towards the integration of rich and complex knowledge, it must be continually open to complementary ideas and knowledge across employee interactions allowing for the dynamic and continual re-visiting of concepts that rejoins the dialectical synthesis approach advocated by Nonaka and Toyama [35]. Innovation approaches based on the stage gate system such as that proposed by Cooper [19], and seen in companies such as DaimlerChrysler, etc. [56], have the potential to significantly reduce costs and also highlight the importance of multi-disciplinary teams. But while the latter is important in achieving requisite variety, its full potential is not nearly as attained if on-going sense-making occurs solely across deductive ‘either/or’ dialogue and practices. It is by continually synthesizing different ideas and concepts (old, new, internal, external, etc.) that an optimum or ‘best of all worlds’ can be further approached. Too much focus on any one element of a given dyad (e.g. standardization/efficiency over creative change) leads to lopsided results: either too much emphasis on creativity or too much emphasis on efficiency and cost reductions.

So while Honda’s total cycle times may be average at best, high idea synthesis and throughput can be achieved for any given time period (for example, two prototypes were built prior to the final version of the Ridgeline), thus increasing the chances of distinctive innovation; and yet because many ideas are built upon existing expertise and lessons-learned, cost can also be maintained within reasonable levels.

B. Required Enabling Conditions

References [37] and [39] speak of various conditions that enable organizational knowledge creation and circulation to occur. One of these enabling conditions is, as discussed earlier, instilling a knowledge vision. But in order for this knowledge to interact in a manner that involves the continuous re-visiting and re-adjustments of ideas and concepts in a manner that integrates and synthesizes the continual input of differing viewpoints and ‘contradictions’ (or dyads), individuals must first feel secure to interact with one another in an environment of openness, tolerance, and respect. Hence, it becomes primordial that there be an environment in which management nurtures mutual trust, empathy, and care. The presence of mutual trust, empathy and care means that individuals are more likely to share their personal contexts and knowledge leading to what Nonaka et al [61]refer to as ‘ba’. But it also means that there is more likelihood for tolerance and openness to differing viewpoints, whereby discussions as well as open debating of ideas can occur within a context of respect and mutual trust. This openness and tolerance on the part of individuals not only allows synthesis of various knowledge dyads to occur (thereby increasing the chances of generating disruptive innovations), but also allows different ontological (individual to group to sub-organization) and epistemological (tacit and explicit knowledge) dyads to synthesize together thereby leading towards the creation of the dialectical firm as illustrated in section V-A. For example, Vaughan [63] and Weick [27] explain how the Challenger Disaster could have been avoided had critical informal tacit knowledge that certain Thiokol engineers possessed been able to circulate freely amongst the different parties at a key meeting preceding the ill-fated launch. Unfortunately, a climate of fear coupled with the lack of face-to-face interaction, and too high a dependency on formal rules and codified knowledge prevented this from happening.

Openness to differing viewpoints coupled with the somewhat more classical enabler of requisite variety [50] of personal experiences and backgrounds, also espoused by evolutionary economic and complexity theorists alike (postulating that an organization’s internal diversity must match the variety and complexity of the environment in order to deal with its challenges) increases the likelihood that peripheral ideas/concepts or ‘weak signals’ as described by Day and Schoemaker [62] are integrated within the knowledge creation process. This again, increase the likelihood of generating disruptive innovations. The fostering of debate and eventual synthesis of differing ideas at Honda is one source of requisite variety. Another source was the complementarity of technical and marketing know-how that was achieved across the GE/Honda alliance with respect to the HF118 engine. And
finally, having people with different backgrounds and functions around a table brings forth the needed diversity required to tackle the numerous aspects of a complex problem. Reference [42]’s description of Honda illustrates this: “Design and development teams are deliberately staffed with engineers from peripheral disciplines who are unfamiliar with the core technology under development. This is designed to ensure that problems will be approached from different and innovative perspectives…” We can deduce that some of the technology leveraging of Honda’s existing automotive technologies into the MH-02 and HondaJet aircraft development programs may in part be explained by the presence of engineers from peripheral disciplines involved in these two programs.

Added to this is redundancy of information or knowledge whereby there is an existence of information or knowledge that goes beyond the immediate operational requirements of organizational members. This involves the intentional overlapping of information and business activities and management responsibilities. By sharing a concept with other individuals who may not need the concept immediately, more sharing of tacit knowledge is promoted because an individual can sense what others are trying to articulate. In this sense, redundancy of information speeds up the knowledge-creation process. An example would be in concept development whereby individuals are trying to articulate images rooted in tacit knowledge: here redundant information enables individuals to invade each other’s functional boundaries and offer advice or provide new information from different perspectives [39]. This reflected in Honda’s brainstorming camps, where these “meetings are not limited to project team members but are open to any employees who are interested in the development project underway” [39: p.63]. This too, can increase the likelihood of generating disruptive innovations.

VII. SUMMARY AND CONCLUSIONS

In the first section of this paper, we briefly examined the evolution of certain technical aspects and technologies that led to the HondaJet and its differentiating attributes of superior fuel efficiency and cabin space. We were able to trace the type of technical and design coherency across three different aircraft development programs that collectively spanned over 19 years – namely, structural composite materials development, above-wing engine mount concepts, a ‘safety first’ design philosophy, a high emphasis on quality control, and finally, a large cabin space and automobile design themes. But accompanying this coherency was a constant generation of innovating concepts (e.g. forward swept wings on the MH-02, laminar flow technologies on nose, fuselage and wing of the HondaJet, FADEC engine controls on the HF118, etc.). In similar fashion, we saw degrees of coherent continuity within the Ridgeline development activities with respect to its roots in Honda’s Pilot and MDX unibody construction, as well as transmission and suspension design approaches.

We then attempted to show that these innovations were achieved within a dialectical firm whereby contradictions or dyads are synthesized through “dynamic interactions among individuals, the organization and the environment” (Nonaka et al, 2003: 2). Furthermore, both the HondaJet and the Ridgeline in fact constitute disruptive innovations as defined by Christensen [3] in that both not only improved their existing performance attributes but added a new one related to car-like handling, comfort and space. This was most visibly seen across the synthesis of past vs present, old vs new and internal vs external knowledge dyads. The constant balancing and synthesizing of these knowledge dyads along with other ontological and epistemological dyads encountered throughout the organization and its environment allows one to approach the ‘best-of-all-worlds’ (e.g. ‘creative routines’) resulting in distinctive innovation at relatively low costs. This approach can be combined to other techniques that can add significant improvements in cost and/or speed efficiencies (such as stage-gate systems, ERP, enhanced computational design tools, etc.).

But managing an organization within a dialectical firm, with its very nature of constantly requiring an openness to alternative and differing views, aspects and concepts, requires special emphasis on mutual trust, care and empathy so that individuals and groups feel comfortable and secure in the sharing and exchanging of views and ideas. Furthermore, requisite variety of backgrounds and experience, as well as redundancy of knowledge further enhances this sharing and exchange so as to produce a richer and more complex knowledge able to cope with the complexities and turbulence of the environment. It is this synthesis of various ‘contradictions’ or viewpoints that gives the firm and its resulting disruptive innovations the simultaneous characteristic of continuity and novelty.

We realize that a major weakness of this paper lies in its purely conceptual nature, and that it relies solely on second hand verbatim and technical data. Future work is currently being envisaged to enter Honda firsthand so as to verify our propositions.

REFERENCES
